**Name:**

**Celestia Activity**

**Directions:** Please read, and carefully follow the directions provided. Answer all questions as well.

1. Open the Celestia application.
2. If the demo does not begin automatically, click “Celestia” and then “demo.” Take a few minutes to watch the demo. **What kinds of features were shown during the demonstration?**
3. After watching the demonstration, you should find yourself back at Earth. If not, click “Location” then “Select.” Type in “Earth” and hit Enter. Now hit the “C” button once followed by “G.” \*Notice that some important info about Earth appears in the upper left corner of your screen. **What are the first 2 pieces of info provided?**
4. Click “Display,” “Orbits,” and make sure the orbits of planets, moons, and minor moons are selected.
5. OK, lets find out what it’s like to travel to the moon at the rate the space shuttle travels. Click “Location” then “Select.” Type in “moon” and hit Enter. Now hit the “C” button. You should be able to see it if you look carefully. Now watch the lower left screen corner and begin to **tap** the “A” button until you reach a velocity of about **11 km/sec**. This is the rate the Apollo spacecraft traveled at in 1969. It is the fastest speed human beings have ever traveled and is equal to about 24,600 mph. **Considering the moon is about 384,400 km away on average, calculate how long it would take to reach the moon at this rate (show work): time = distance / rate**

\*Note: this will yield an answer in seconds. Divide this answer by 60 twice and then by 24 to get a final answer in days:

1. To gain some perspective, calculate how long it would take to reach the moon traveling at 100 km/**hr.** (This is about how fast you travel in a car on the highway)

**(show work): time = distance / rate**

Divide your answer by 24 to get a final answer in days:

1. Now feel free to **tap** “A” some more until you see the moon getting closer. Click “S” to stop or “Z” to slow down. If you fly past it, you can follow the steps described in #3 to get back.
2. As you view the moon, notice big dark areas and lots of light colored holes called craters. Earth, the moon, and other bodies in our solar system have been bombarded by asteroids for billions of years. Research and answer this question: **Why does the moon have so many visible craters, and earth doesn’t?**
3. OK, lets find out what it’s like to travel to Jupiter at the rate the space shuttle travels. Click “Location” then “Select.” Type in “Jupiter” and hit Enter. Now hit the “C” button. Now look in the lower left corner and begin to **tap** the “A” button until you reach a velocity of about 11 km/sec. **Considering Jupiter is about 778,000,000 km away on average, calculate how long it would take to reach Jupiter at this rate (show work): time = distance / rate**

Again, divide your answer by 60 twice, and then by 24 to get a final answer in days:

1. Obviously we want to get there much more quickly, so lets travel at the speed of light and see how long it takes now. Look in the lower left corner and begin to **tap** the “A” button until you reach a velocity of about 1 c. (That is the speed of light). Research to **find out how long it would take to get from Earth to Jupiter at light speed. Also, explain how fast light travels.**
2. On average, Jupiter is about 5.2 AU from the Sun and 4.5 AU from earth. **Please explain exactly what an AU is?**
3. If you’re not at Jupiter, follow the directions in step 3 to get there. You should now be able to observe the many orbiting moons. You can even fly around Jupiter a bit and try to find the Great Red Spot. **Please research and answer the following:**

* How many major (Galilean) moons does Jupiter have? What are they? What are they like?
* How many minor moons does Jupiter have?
* What is the Great Red Spot?
* Jupiter was/still is referred to as a “gas giant.” Why? How big is it compared to Earth?
* We now know of planets that are even bigger. Where are they? How big are they?

1. For years scientists have been suggesting that Jupiter’s moon Europa may be able to support at least microbial life. Head over there and find out why based on the appearance of the surface. **Describe the appearance of Europa’s surface and why scientists think life might be possible:**
2. Follow the directions in step 3 to fly over to Saturn. **Describe what you find there:**
3. Follow the directions in step 3 to fly out to Pluto. Once there, please click “location,” “select” and type in sun. Click “C” to center it on your screen. **How far away are you from the Sun?**
4. Everyone is always asking me, “Why isn’t Pluto a planet anymore?” **Well why isn’t it?**
5. Research and find out: **what/where is the outermost boundary of our solar system?**

\*Note: I don’t think the Kuiper belt nor the oort cloud may be found on Celestia. Use the Internet.

1. **What is the Kuiper belt? (Tell me something interesting about it)**
2. **What is the Oort cloud? (Tell me something interesting about it)**
3. Now use your sweet Celestia skills to head over to Triton. Once there, use your arrow keys to swing the ship around a bit. **What’s that bright blue planet you see nearby?**  (\*If it’s not bright blue, you may need to fly around to the side facing the sun.)
4. OK, now it’s off to visit a comet. Again, use “Location” then “Select.” Type in “Halley” and hit Enter. Now hit the “C” button, followed by the “G” button. **What does it look like? Why?**
5. While out by Halley, select the Sun and again center it on your screen. **How far away is it? How close does Halley get to the Sun at it’s perihelion?**

**How far away does Halley get from the Sun and how often?**

1. OK, now it’s off to visit our closest neighboring star. Again, use “Location” then “Select.” Type in “Proxima centauri” and hit Enter. **How far is it from our solar system?**

Now hit the “C” button, followed by the “G” button. **What does it look like compared to other stars? Why?**

1. Research. **What percentage of stars is believed to be red dwarfs?**
2. Research. **Approximately how many stars make up the entire visible universe?**
3. Research. **Are there more stars in the universe, or grains of sand on Earth?**
4. OK, time for your own personal exploration. Use your arrow keys to roll the ship around a bit. Find something off in the distance and click on it. Click “C.” **What is it and how far away is it?**
5. Now begin to tap and hold the “A” key for a couple seconds at a time until you accelerate to the point where you begin to fly by many stars. **How fast are you traveling now?**

**What does the unit ly/s stand for?**

1. Again accelerate to the point where you begin to move past many stars. Use your arrow keys to steer the ship. Find a bright star off in the distance and try to keep it directly in the center of your screen. \*Note: you may have the best luck if you continue to “roll” the ship in one rotational direction. Continue to try to manually fly the ship to your target star getting as close as possible before hitting the “S” key to stop. Try and try again if you need to. **How close were you able to get?**
2. **Explain in detail why it is so difficult to manually fly in and stop close to a star:**
3. One last time use the arrow keys to swing your ship around and around until you find what you believe to be a galaxy off in the distance. \*It should look like a big cloud very far away. Keep looking until you find one. Click on it. **How far away is it?**
4. **What is a parsec? How does it compare to a light year?**
5. **What is a Kpc?**
6. Finally, Research. **According to our current best estimates, how big is the visible universe today and how will this change over time?**